**INVENTION:** Complex Walsh Codes for CDMA

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## ABSTRACT

The present invention describes a new set of complex Walsh and hybrid complex Walsh orthogonal codes for CDMA channelization encoding and decoding. Current art uses real 2-phase Walsh orthogonal codes for spreading and orthogonal channelization encoding of the data for the CDMA signal. Complex CDMA is widely known to be better than real CDMA and the current art generates complex CDMA by using real Walsh codes together with pseudo-noise bi-phase (PN) codes to generate a complex CDMA signal. The new 4-phase complex Walsh orthogonal CDMA codes provide fundamental performance improvements which include an increase in the carrier-to-noise ratio (CNR) for data symbol recovery in the receiver, lower correlation side-lobes under timing offsets both with and without PN spreading, lower levels of harmonic interference caused by non-linear amplification of multi-carrier CDMA signals, and reduced phase tracking jitter for code tracking to support both acquisition and synchronization. Hybrid complex Walsh orthogonal CDMA codes increase the choices for the code length by allowing the combined use of complex Walsh and discrete Fourier transform complex orthogonal codes using a Kronecker construction, direct sum constructioin, as well as the possibility for more general functional combining.